

## **Plasma Surface Interactions and Life-Limiting Phenomena in Ion Engines**

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Xenon ion propulsion is entering an age of application in NASA's planetary program, as a key technology currently being demonstrated on Deep Space 1 (DS1). The single ion thruster on DS1 propelled it to an encounter with the asteroid Braille in July 1999 and is now being used to provide the Delta-V for a flyby of the comet Borrelly in 2001. It will deliver a total Delta-V of 4.5 km/s to the 486 kg spacecraft during this mission while consuming less than 81 kg of xenon propellant. With this successful demonstration, ion propulsion is now being considered for a broad range of future planetary missions. The high specific impulse capability of ion thrusters makes it possible to perform these demanding outer planet and sample return missions using smaller, less expensive launch vehicles and often with shorter trip times. However, the low thrust levels that ion engines provide necessitate extremely long burn times, typically thousands to tens of thousands of hours per engine. Many of the potential failure modes that limit ion engine life are driven by plasma-surface interactions in the engine. The experimental characterization of wear processes from long duration ground testing and current theoretical understanding of the erosion mechanisms will be discussed in this presentation.